

NOTES ON SOME AUSTRALIAN VOLUTIDAE

By DONALD F. McMICHAEL, Ph.D.*

In the course of routine museum work, a number of interesting volutes have been submitted for identification or study during the past few years. In some cases, animals have been presented from which radula slides have been prepared, and these have yielded some interesting results. The following notes are intended to record some of the conclusions reached in preparation for a comprehensive study of the Volutidae.

For convenience, the various groups will be treated in the order suggested by Pilsbry and Olsson (1954), though this does not mean complete agreement with the scheme outlined by them. Study of the Australian representatives of this family has convinced me that the Volutidae can only be understood if they are conceived of as a series of relic genera, the end products of a major Tertiary evolution, now moving towards extinction. Only a few groups are really successful recent genera with more than a few species. These include the Australian genera *Amoria*, *Cymbiolacca*, *Aulica*, the Japanese *Fulgoraria*, the New Zealand *Alcithoe*, and the large-shelled genera *Melo* and *Cymbium*.

Subfamily ATHLETINAE Pilsbry and Olsson.

Genus *TERNIVOLUTA* Martens.

Ternivoluta studeri Martens.

Reference: McMichael, 1959, *Proc. Roy. zool. Soc. N.S.W.*, 1957-58, pp. 60-62, fig. 1.

Remarks: When I recorded the rediscovery of this species from Tin Can Bay, I noted that Schacko (1881) had previously figured the radula under the name *Voluta (Psephaea) concinna* (a Japanese species of *Fulgoraria*), but I did not consider the radula further. The genus *Ternivoluta* was placed next to *Volutocorbis* Dall by Thiele and by Pilsbry and Olsson, an arrangement which I followed on the shell characters, notably the columellar plaits. Study of the radula figured by Schacko shows that the species has a triserial radula very similar to that described for *Volutocorbis abyssicola* Adams & Reeve, thus confirming the generic relationship.

Since then, numerous specimens of *T. studeri* Martens were collected by the M.V. "Challenge" in December, 1959, from 68 fathoms, N.N.E. of Cape Byron, northern N.S.W. One of these contained an animal which was forwarded to me for study. This proved to be fairly typically volutid, but the siphon has no appendages (agreeing with *V. abyssicola* fide Pace (1902), p. 28). The eyes are carried at the end of short rounded eye-stalks, again agreeing with *V. abyssicola*. The colour pattern is of dark brown to black flecks and streaks over the dorsal surface of the foot, head and siphon. The radula agrees in detail with that described by Schacko, even to the exact number of rows of teeth, viz. 117; a typical row is illustrated in Text fig. 1, A.

*Curator of Molluscs, The Australian Museum, Sydney.

Subfamily FULGORARIINAE Pilsbry and Olsson.

Genus MESERICUSA Iredale.

Mesericusa sowerbyi (Kiener).

Voluta sowerbyi Kiener, 1839, Coquilles Vivantes, *Voluta*, pp. 47-48, pl. 50.

Remarks: This well-known eastern Australian shell has never been studied for animal and radula morphology, though it is one of the commonest of the deep-water volutes. Iredale (1929, p. 181) separated the species under the new generic name *Mesericusa*, naming the New South Wales form *M. sowerbyi perspecta* Iredale as type. Previously the species had been referred to *Ericusa* H. and A. Adams (type species by subsequent designation, Cotton and Godfrey, 1932, *S. Aust. Nat.*, 13, p. 49, *Voluta fulgetrum* Sowerby, 1825), but Iredale separated it on conchological grounds.

The animal of *E. fulgetrum* (Sowerby) has not, to my knowledge, been studied, but the radular tooth of its congener, *E. papillosa* (Swainson) was figured by Cooke (1922, fig. 8). This has a most unusual structure, being unicuspid, with a long, narrow central cusp set on a broad basal plate. This tooth structure seems to be unique among the Volutidae, though it recalls the *Scaphella-Amoria* type of radula, as Cooke suggested. If *E. fulgetrum* (Sowerby) proves to have a similar radula, then the genus *Ericusa* would seem to stand apart from the other Australian genera assigned by Pilsbry and Olsson to the Fulgorariinae.

Mesericusa sowerbyi (Kiener) exhibits considerable variation over its range from Tasmania to north New South Wales. The large, northern specimens which Iredale named *M. sowerbyi perspecta* may constitute a geographic race, but more specimens are required to answer this question. A single preserved animal, trawled by M.V. "Challenge" in 95 fathoms off Tuggerah Lakes, N.S.W., was available. The animal is a beautiful shade of reddish-purple, with numerous cream spots, circles and ovals covering the dorsal surface of the foot, head, siphon and penis. The siphon is long, firm, with fairly long, sub-equal appendages; the head is broad, with enlarged lateral lobes and slender tentacles, the eyes situated at their bases. The penis is a huge structure, some 2 in. or 3 in. in length in the preserved specimen, about $\frac{1}{2}$ in. in thickness, with an approximately round cross-section but ridged along one side, and tapering to a blunt point. In preservation the penis is curled back behind the head, with its tip hidden under the edge of the mantle, and it probably lies in this position during life.

The radula is very large, with big, tricuspid teeth, their bases deeply and evenly arched, the number of rows 61. The teeth compare in general with those of *Livonia roadnightae* (McCoy) figured by Verco (1912, pl. 16, figs. 1-2), and the number of rows in the latter (70) agrees generally. A tooth from the radula of *M. sowerbyi* is figured in Text fig. 1, B.

Subfamily CYMBIINAE H. and A. Adams.

Genus AULICA Gray.

Aulica Gray, 1847, *Proc. zool. Soc. Lond.*, 1847, p. 141. Type species by monotypy, *Voluta aulica* Sowerby, 1825.

Remarks: I have previously discussed the use of this generic name for Australian volutes (McMichael, 1959, p. 375). Since then I have made some effort to find out which species should bear the name *Aulica*

aulica Sowerby, but this is still in doubt. However, the generic name is certainly applicable to the series of volutes found in Queensland and northern Australia, which have been variously known under the names *flavicans* Gmelin, *scafa* Solander, *signifer* Broderip, *mariaemma* Gray, *tissotiana* Crosse, *quaesita* Iredale, and *kellneri* Iredale.

There has been much discussion among collectors as to the validity of the last two names, and in an effort to determine the matter I have considered each of these names in detail, with results as follows.

Voluta scafa Solander, 1786. This name has recently been used by Maxwell Smith (1942, p. 41) and Cotton (1949, p. 188, 189) for the spinose form of the species usually referred to as *flavicans* Gmelin. Smith (1942) included *flavicans* Gmelin, *volvacea* Lamarck, and *signifer* Broderip in the synonymy of *scafa* Solander. How this conclusion was reached I cannot understand, for reference to the Portland Catalogue, where the name *scafa* Solander was introduced, shows that it is based on a figure in Adanson (1757, pl. 3, fig. 2), which is of a species of *Cymba* generally known as *porcina* Lamarck (based on the same figure). Therefore *Voluta scafa* Solander can be rejected for the present species.

Voluta flavicans Gmelin, 1790. This species was described from unknown locality, and only a few words of description are given. However two figures are cited, Seba, Plate 67, figs. a, b, and Martini, Conch. Cab., vol. 3, pl. 95, figs. 922 and 923. Only the latter work is available to me, and it shows a shell which is unquestionably the same as some of the northern Australian specimens, including paratypes of *Aulica quaesita* Iredale. This is a small, creamish-yellow shell, with obscure dark spots, without nodules or spines of any kind on the shoulder of the whorl, and with four strong columellar plaits. If the Seba plate shows a similar shell, then there can be no doubt that the name *Aulica flavicans* (Gmelin) should be applied to the "*quaesita*" type shell. The use of the name *flavicans* for the spinose shells probably is due to Sowerby (1844) and Reeve (1849), both of whom figured spinose shells as well as smooth ones. The presence or absence of spines however seems to have no taxonomic significance. *Voluta volvacea* Lamarck is an absolute synonym of *flavicans* Gmelin.

Voluta signifer Broderip, 1848. This was described briefly without figures or exact locality, though the specimen came from a Dutch collector, so that an Indonesian locality such as Amboina is not unlikely. The description indicates one of the *quaesita* series, but the exact identity will depend on an examination of the type. Reeve (1849) noted that the shell described by Broderip "is an elongated form of *V. flavicans* in which the lip is not quite mature". If a comparison is made with the specimens of *flavicans* figured by Reeve (both of which are stout shells) it follows that *signifer* must be very like the shell generally known as *tissotiana* or *kellneri*.

Scapha maria-emma Gray, 1859. This fine shell has been regarded as a northern Australian species, but the species was described as coming from Singapore (but with the reservation that it probably came from one of the Malayan Islands, Singapore being "merely the entrepot"). Examination of the figure given by Gray shows a most unusual shell, having the general shape and proportions of a northern Australian shell, but with the colour pattern and size of the common Indo-Malayan species generally known as *scapha* Gmelin, but which correctly should be called *Volutocorona nobilis* Solander. Until the type of *mariaemma* Gray can be

examined, it can be regarded as a form of *V. nobilis* Solander and not from Australian waters. Crosse provided the substitute name *grayae* for this species, on the grounds that *Scapha maria-emma* was not binomial; however this is not considered valid reasoning to-day, the name merely being written without the hyphen.

Voluta tissotiana Crosse, 1867. This shell was described from unknown locality, but it was compared with *flavicans* and *signifer*, and the figure shows a shell without doubt from northern Australian waters. Brazier identified shells collected at the Liverpool River, Arnhem Land, by the Cadell expedition in 1868 as *tissotiana*, and the name was generally used afterwards for the larger, less shouldered specimens from northern Australia. Iredale rejected it as an Australian shell, on the grounds that the specimen, which came from Robillard of Mauritius, was not Australian, but from Mauritius or a neighbouring island. However, our knowledge of volute distribution immediately rules out this suggestion, for the genus *Aulica* occupies a discrete range (like most volutid genera), and there are almost certainly no volutes of this group to be found outside the Australian-Indonesian-Coral Sea area. Iredale claimed that North Australia was still inaccessible at the time of naming, so a locality such as Timor, Amboina, or Ceram is probable, for shells of this type occur in southern New Guinea waters. This is the same form as was later named by Iredale *kellneri*, but whether it is the same as *signifer* Broderip remains to be seen.

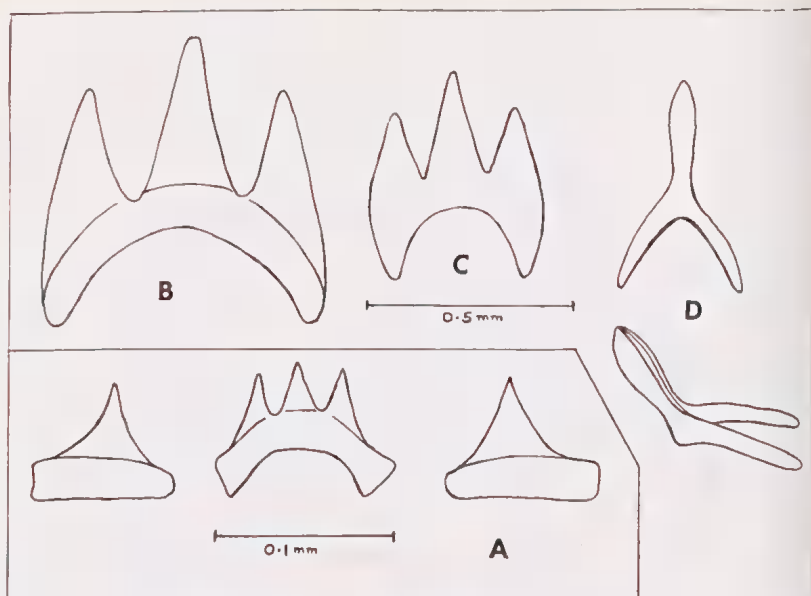
Aulica quaesita Iredale, 1956. The holotype and a series of paratypes of *Aulica quaesita* are in the Australian Museum. I am quite convinced that the series falls within the range of variation of the common northern Australian species, and this will bear the name *flavicans* Gmelin.

Aulica kellneri Iredale, 1957. This shell was separated from "*quaesita* Iredale" because of its more elongate form and spotted colour pattern. However, as indicated previously, I can see no grounds for the rejection of the earlier name *tissotiana* Crosse for this form. Whether there are two distinct species to be found in northern Australia, or only one, I am unable to decide. The series of specimens in the Australian Museum is not large enough to enable any valid conclusion to be reached. However, in view of the fact that volutes, because of their habit of laying attached eggs which hatch as crawling young, tend to develop colonies or populations of a fixed type with limited variability, but with each population differing from neighbouring ones, I think it likely that the northern Australian populations represent only a single, widespread species, which must bear the name *Aulica flavicans* Gmelin, with the names *signifer* Broderip, *tissotiana* Crosse, *quaesita* Iredale, and *kellneri* Iredale as synonyms.

Aulica flavicans (Gmelin).

Voluta flavicans Gmelin, 1790, Systema Naturae, Ed. 13, p. 3464.

Remarks: The radula and animal characters of the species *vespertilio* L. and *sophia* Gray and (in part) *rutilla* Broderip are known, but as the first is the type of the subgenus *Aulicina*, while the second may also be referable to that group or to *Cymbiola*, only *rutilla* Broderip refers to *Aulica* s.s.. The last named species was mentioned by Cooke (1922) as being included in the Gwatkin collection of radula slides, and Cooke noted that there were 71 rows, while the teeth had a Segmental Angle of 107°. However, the teeth were neither figured nor described. Consequently our knowledge of the typical *Aulica* radula has been strictly limited.



Text fig. 1.

Note: Figs. B, C, D are to the same scale.

A. A single row of radular teeth of *Ternicoluta studeri* Martens.

B. Radular tooth of *Mesericusa sowerbyi* (Kiener).

C. Radular tooth of *Aulica flavicans* (Gmelin).

D. Radular teeth of *Cymbiolista hunteri* Iredale, dorsal and lateral-oblique views.

A specimen of *A. flavicans* was collected alive by Mr. C. F. Kurtze, of Portland, Victoria, at Shoal Bay, near Darwin, N.T. Many specimens were seen on the mud-flats at low tide, and there were innumerable egg masses, attached to mangrove roots. Some additional information on the breeding habits of this species were given by Mr. Herbert T. Ward, of Guam, to Mrs. D. I. Hartley, of Melbourne, who kindly handed to me the specimen and Mr. Ward's notes for this paper. The specimen described is now in the Hartley collection.

The sides of the foot were a mottled purplish-brown colour, otherwise the animal is cream after some months preservation. The siphon is very prominent, stout and projecting, but not very long, with small subequal appendages. The head is small, without prominent tentacles, and with the eyes scarcely visible. The radula consists of a series of 46 tricuspid teeth, typically volutid, with arched base, long central cusp and shorter side cusps (Text fig. 1, C).

The egg masses collected by Mr. Kurtze were rather contracted in the alcohol preservative, but in life probably consisted of a number of spherical capsules, creamish-white in colour, and joined together in masses of 20 or more capsules. Each capsule of the egg masses collected contained a single, small shelled embryo, the shell consisting essentially of the protoconch of the adult, of $3\frac{1}{2}$ whorls 11 mm. long by 7 mm. diameter, white with just one or two brownish markings towards the outer lip.

Mr. Ward noted that live specimens were taken on the surface of the mud in the act of laying eggs. The animal assumes a near perpendicular position with about two-thirds of the spire of the shell buried in the mud. The eggs are laid in clusters of transparent capsules attached to loose sticks or other mud-lodged debris which has been carried out by the tide. In one case two live shells were taken completely buried in the mud, with the egg mass above them, at a depth of approximately one foot. In another locality (Sampan Creek) numerous live specimens were found crawling on one small muddy area, and some specimens were again found buried under eight or ten inches of mud. However, this species must spend most of its time above the surface of the bottom mud, as the specimen dissected was carrying living barnacles of considerable size on the dorsal surface of the shell.

Genus *VOLUTOCONUS* Crosse.

Voluta (*Volutoconus*) Crosse, 1871, *J. Conchyliol.*, 19, p. 306. Type species by monotypy, *Voluta conformis* Cox.

Remarks: Cox described *Voluta conformis* in 1871, with an excellent figure and detailed description, from Nichol Bay, North-west Australia. The unique colour and form of the species caused Cox to write at the time "L'ensemble de ces caractères permettrait, peut-être, de créer, pour cette forme originale, une section particulière du genre *Voluta*".

This challenge was taken up by Crosse in the same year when he introduced *Volutoconus* for this species only, placing the section between "*Volutolithes* Swainson" (= *Volutocorbis* Dall) and *Callipara* Gray.

The genus received little attention subsequently, but some additional species were suggested as relatives of *V. conformis*. First, Martens, when recording *Voluta bednalli* Brazier in the *Zoological Record* for 1879, commented "very near *conformis* Cox", a suggestion which was accepted by Hedley (1915), who used *Volutoconus* as a subgenus of *Cymbiola* for these two species; and recently Abbott (1958) suggested that *grossi* Iredale originally described as an *Amoria*, belonged with *bednalli* in *Volutoconus*, but expressed some doubt as the animal of *V. conformis* Cox has not been examined. He also mentioned *Voluta hargreavesi* Angas as a possible relative, because of its resemblance to *V. grossi*. Allan (1956) had previously suggested that *hargreavesi* Angas and *grossi* Iredale were synonyms.

In all the years since 1871, to my knowledge, no specimen of *Volutoconus conformis* has been noted in literature, nor has any figure or description been given, other than those copied from the original description. It is therefore pleasing to report the rediscovery of this species from two localities in Western Australia. A magnificent shell in the collection of Mr. A. Whitworth, of Carnarvon, was generously loaned for study. It was taken alive in about ten fathoms off La Grange Bay, Cape Bossut, about 250 miles north-west of the type locality. This specimen is illustrated on Plate 1, fig. 2. A second specimen, considerably smaller and with an imperfect lip, is in the National Museum of Victoria, part of the Hartley Collection, registered as No. F.21090. This was taken by a skin-diver off Broome, W.A.

It is also of interest to record the rediscovery of *Voluta hargreavesi* Angas. This species was described without locality, but an excellent figure was given, showing a shell broader than *grossi*, with the apex flattened,

with the white triangle colour pattern on a reddish-orange ground. A specimen of this general description was reported to be in a Western Australian collection. Unfortunately, I was unable to borrow the specimen for study, but kodachromes kindly provided by Mr. Whitworth show that the shell is certainly the missing *hargreavesi*. The locality is uncertain, but probably the Abrolhos Islands, and certainly southern Western Australia.*

Study of these shells has convinced me that all four species, *coniformis* Cox, *bednalli* Brazier, *hargreavesi* Angas, and *grossi*, are members of one genus. The apical sculpture of *coniformis* consists of numerous, fine radial ribs developing after the first two whorls, which are smooth (Plate 1, fig. 3). The slides of *hargreavesi* show a very similar sculpture, and radial ribbing is also seen in good specimens of *bednalli*. The original specimens of *grossi* found some years in Tin Can Bay, Queensland, and described by Abbott (1958) were absolutely without sign of radial sculpture on the apical whorls, which were glossy, with an exsert terminal papilla. However, specimens collected recently in the general neighbourhood of Yeppoon and the Keppel Islands, do possess radially ribbed protoconchs. The ribs are more widely spaced than in the northern and western Australian species, and are covered with a glaze. A protoconch of this type is illustrated in Plate 1, figure 4.

There are some differences between the polished slender shells of *Volutoconus grossi* and those of the squat, reticulated sculptured *coniformis*, but these are linked by *hargreavesi*, which appears to have an unpolished, relatively stout, but unsculptured shell, and all share a similar colour pattern. *Voluta bednalli* Brazier differs in colour, but agrees well with one or other of the remaining species in shape, sculpture and radula tooth structure.

When Abbott (1958) described the radula of *grossi*, he was unable to give any morphological characters of the animal. A specimen of the animal, received from Mr. C. F. Knight, revealed the following features. The foot is banded with orange-red or pinkish bands on a cream background. The siphon is elongate, with long equal appendages. The head is compressed, with slender tentacles, the eyes prominent at their bases. The radula consists of 35 tricuspid teeth as noted by Abbott. It is noteworthy that the teeth are set at alternating angles on the basal membrane, so that the long central cusps are set in just the same manner as the teeth on a rip-saw.

The genus *Volutoconus* Crosse may be redefined as follows: Volutes of the subfamily Cymbiinae, with brightly coloured shells, either of blackish-brown, spiral and longitudinal bands on a cream shell, or of cream to white triangles on an orange-red to deep reddish-brown background. Spire elevated or quite depressed, apical whorls prominently radially sculptured with fine ribs, these sometimes obscured with an overlying glaze; with a central projecting papilla at the tip of the first whorl. Adult whorls in some species with fine, reticulate sculpture; in others smooth, with growth ridges only. Columellar plaits four or five, promi-

*A second specimen, agreeing in detail with the figure and description of *V. hargreavesi* Angas, was dredged alive off the central coast of Western Australia by the "Davina" during the Hawaiian-West Australian expedition of May/June, 1960. It will be reported upon at a later date.

nently developed, or smaller, widely spaced. Radula (where known) uniserial, with about 35-40 large, tricuspid teeth.

Subfamily SCAPHELLINAE H. and A. Adams.

Genus CYMBIOLISTA Iredale.

Cymbiola (*Cymbiolista*) Iredale, 1929, *Rec. Aust. Mus.* 17, p. 181. Type species by original designation, *Voluta marmorata* Swainson (= *Cymbiolista hunteri* Iredale).

Remarks: Hedley (1915) referred the species *marmorata* Swainson to *Aulica*, but later transferred it to *Cymbiola* (Hedley, 1918, p. M 73). Iredale separated it subgenerically from *Cymbiola*, later (1931, p. 223) raising it to full generic rank, at the same time renaming the species, *marmorata* being preoccupied. Smith (1942, p. 52) listed the species under *Amoria* without explanation, though the shell does not resemble an *Amoria* in any way. Pilsbry and Olsson (1954) overlooked the genus, unless they regarded it as included in *Cymbiola*.

A specimen of *C. hunteri* Iredale in the Australian Museum, No. C.16374, part of the "Thetis" collection from off Cape Three Points, N.S.W., in 41-50 fathoms, revealed a typically volutid animal, but the radula was of the *Amoria* type, very long, with approximately 267 teeth, Y shaped with a single, broad blade-like central cusp, and a deeply indented basal plate (Text fig. 1,D). Thus the reference of this species to the neighbourhood of *Amoria* is confirmed, and the genus *Cymbiolista* must be placed in the present subfamily.

Genus NANNAMORIA Iredale.

Nannamoria Iredale, 1929, *Rec. Aust. Mus.*, 17, p. 181. Type species by original designation, *Nannamoria amicula* Iredale.

Remarks: This genus was erected for a single species dredged off Montague Island, N.S.W. No generic characters were given, apart from the species description, and no comparative characters were indicated saving the statement, "a very curious little shell, suggesting *undulata* in miniature".

Subsequently Cotton (1949) included two South Australian recent species, *guntheri* Smith and *adcocki* Tate in the genus, as well as several Victorian and Tasmanian fossil species. The discovery of a second species of *Nannamoria* described earlier in this issue prompts reconsideration of the generic classification.

The two eastern species, *amicula* Iredale and *parabola* Garrard are obviously closely related, agreeing in the slit-like mouth, rising up over the penultimate whorl posteriorly, and in the series of fine columellar plaits, alternating with somewhat larger plaits. The protoconch is small, evenly rounded without notable sculpture; the colour pattern is of fine, reddish-brown lines, somewhat wrinkled, but not undulating.

On the other hand, the two South Australian forms, *adcocki* Tate and *guntheri* Smith (which are certainly races of a single species if not merely colour forms) are very different in appearance; they have widely expanded mouths, not produced posteriorly; the four columellar plaits are of normal size; the protoconch is smoothly rounded, white, hemispherical, without any sign of radial ribbing or spiral sculpture in available specimens; the colour pattern is of spaced undulating brown lines; and the shells are nearly twice the size of the eastern species.

In view of these differences, I consider the South Australian species to be generically separable from *Nannamoria*, though a study of the tertiary fossils from southern States suggests that there may be a distant common ancestry. I regard the southern species *adcocki* and *guntheri* as more closely related to the genus *Notovoluta* Cotton (type species *Voluta kreuslerae* Angas), which has a similar protoconch and columellar plaits. The relationship of the latter with the Queensland species *perplicata* Hedley and the new Caledonian *thatcheri* McCoy, remains to be proven.

PARAMORIA gen. nov.

Type Species: *Voluta guntheri* Smith, 1886 (Plate 1, fig. 5).

Description: A genus of volutes with shells of medium to small size, spire comparatively short, body whorl large, aperture three-fifths of total length, expanded, but not produced posteriorly; columellar plaits four, stout; whorls usually angled at the shoulder, bearing a series of blunt spines or knobs; protoconch smooth, hemispherical, of $2\frac{1}{2}$ whorls, of normal size.

Remarks: The recent species range from South Australia to Western Australia, and are found living in from 15-55 fathoms. The fossil species attributed by Cotton to *Nannamoria* were *costellifera* Tate, *lirata* Johnston and *absidata* Cotton. All were found in Victorian and Tasmanian tertiary beds, and because of their comparatively large size, may be related to *Paramoria*, rather than to *Nannamoria*. The animal characters and radula of both *Paramoria* and *Nannamoria* remain unknown, but when found these should throw some light on the relationship between the two groups, as well as their subfamily classification.

REFERENCES.

- ABBOTT, R. T., 1958. Notes on the anatomy of the Australian volutes, *bednalli* and *grossi*. *J. malac. Soc. Aust.*, 2: 2-7, pl. 1, figs. 1-2.
- ADANSON, M., 1757. *Histoire Naturelle du Senegal*. Coquillages. Paris.
- ALLAN, J., 1956. The reappearance of a rare Australian volute shell, *Amoria grossi* Iredale (Mollusca: Gastropoda). *Proc. Roy. zool. Soc. N.S.W.*, 1954-55, 48-49.
- BRODERIP, W. J., 1848. Description of a new species of volute. *Proc. zool. Soc. Lond.*, 1847, 232-233.
- COOKE, A. H., 1922. The radula of the Volutidae. *Proc. malac. Soc. Lond.*, 15: 6-12., figs. 1-8.
- COTTON, B. C., 1949. Australian recent and tertiary mollusca: Family Volutidae. *Rec. S. Aust. Mus.*, 9: 181-196, pl. 13-16.
- CROSSE, H., 1867. Descriptions of d'espèces nouvelles. *J. Conchyliol.*, 15: 195-197, pl. 6, fig. 1.
- GRAY, J. E., 1859. Description of *Scapha maria-emma*, a new species of volute. *Proc. zool. Soc. Lond.*, 1859, 230-231, pl. 48.
- HEDLEY, C., 1915. Studies on Australian mollusca. Pt. xii. *Proc. Linn. Soc. N.S.W.*, 39: 721-725.
- 1918. A check-list of the marine fauna of New South Wales, Pt. 1. Mollusca. *J. Proc. Roy. Soc. N.S.W.*, 51, Suppl., M1-M120.

- IREDALE, T., 1929. Mollusca from the continental shelf of Eastern Australia, No. 2. *Rec. Aust. Mus.*, 17: 157-189, pl. 38-41.
- 1931. Australian molluscan notes, No. 1. *Rec. Aust. Mus.*, 18: 201-235, pl. 22-25.
- 1956. A northern Australian volute. *Proc. Roy. zool. Soc., N.S.W.*, 1954-55: 76-77.
- 1957. Another Australian volute. *Proc. Roy. zool. Soc. N.S.W.*, 1955-56: 91-92.
- McMICHAEL, D. F., 1959. Marine mollusca of eastern Australia 1. The genus *Cymbiolacca* Iredale (Family Volutidae). *Aust. Zool.*, 12: 374-383, pl. 44.
- PACE, S., 1902. On the anatomy and relationships of *Voluta musica*, Linn.; with notes upon certain other supposed members of the Volutidae. *Proc. malac. Soc. Lond.*, 5: 21-31, pl. 2.
- PILSBRY, H. A., and A. A. OLSSON, 1954. Systems of the Volutidae. *Bull. Amer. Paleontology*, 35: No. 152, 1-36, pl. 1-4.
- REEVE, L., 1849. *Conchologia Iconica*. 6: Monograph of the genus *Voluta*.
- SCHACKO, G., 1881. Radula-Untersuchungen. Martens' *Conchologische Mittheilung*, 2: 126-127, pl. 24, fig. 5.
- SMITH, M., 1942. A review of the Volutidae (Florida*).
- SOLANDER, D. C., 1786. Catalogue of the Portland Museum, p. 41.
- SOWERBY, G. B., 1844. *Thesaurus Conchyliorum*. 1: Monograph of the genus *Voluta*., 191-220, pl. 46-55.
- VERCO, J. C., 1912. Shells from the Great Australian Bight. *Trans. Roy. Soc. S. Aust.*, 36: 206-232, pl. 10-16.